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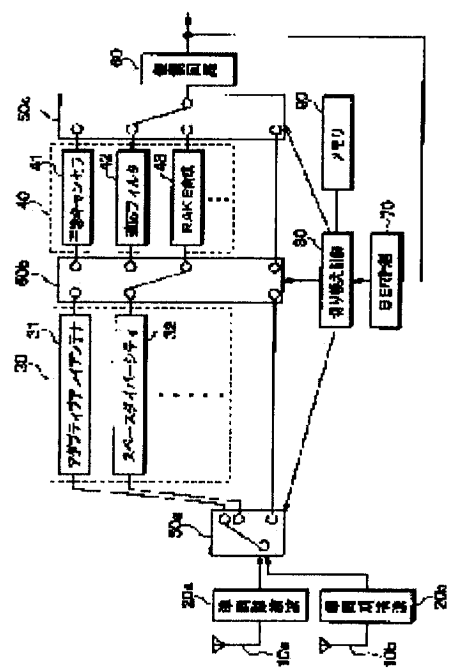
(54) RECEIVER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a receiver that can select an optimum reception system depending on a communication state.

SOLUTION: Changeover devices 50a to 50c select any of first reception system to sixth reception system and a BER measurement section 70 obtains the error rate of a pilot symbol for each reception system. A changeover control section 80 obtains a minimum error rate among the error rates of the pilot symbols for each reception system. That is, the receiver can decides the reception system corresponding to the minimum error rate as an optimum reception system adapted to the operating state of a wireless communication system and an operating environment.



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* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The receiver characterized by to switch to one of receiving methods among each receiving method, and to have a receiving means (30, 40, 50a-50c) to by_which this switched receiving method receives an input signal, and a setting means (70 80) determines one receiving method among each of said receiving method according to said switched input signal of said for every receiving method, and set it as this determined receiving method.
[Claim 2] Said setting means is a receiver according to claim 1 characterized by computing the error rate of said input signal for said every switched receiving method, and setting it as said one receiving method based on said this error rate for said every computed receiving method.
[Claim 3] It is the receiver according to claim 2 which has a judgment means to judge whether the error rate of said received input signal is below a predetermined threshold, and is characterized by said setting means setting up said one receiving method when judged with said error rate being below a predetermined threshold by said judgment means.
[Claim 4] Said setting means is a receiver according to claim 1 characterized by computing SINR of the wave power of choice of said input signal, and interference wave power for said every switched receiving method, and setting up said one receiving method based on said this SINR for said every computed receiving method.
[Claim 5] It is the receiver according to claim 4 which has a judgment means by which said SINR judges whether it is below a predetermined threshold, and is characterized by said setting means setting up said one receiving method when judged with said SINR being below a predetermined threshold by said judgment means.
[Claim 6] Said setting means is claim 1 characterized by setting said one receiving method as a power up thru/or the receiver of any one publication of five.
[Claim 7] claim 1 characterized by said setting means setting up said one receiving method for every fixed period thru/or any one of the 4 -- alike -- the receiver of a publication.
[Claim 8] They are claim 1 characterized by having a positioning means to position positional information, and said setting means setting up said one receiving method when said positioned positional information changes thru/or the receiver of any one publication of five.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the receiver of radio communications systems, such as a cellular phone.
[0002]
[Description of the Prior Art] Conventionally, in the receiver of radio communications systems, such as a cellular phone and wireless LAN, in order to carry out signal processing of the input signal the optimal, various kinds of space signal-processing methods, such as adaptive array-antennas and tooth-space die berth tea, are proposed (refer to JP,2000-49672,A and JP,2000-106505,A).
[0003] Furthermore, in order to carry out signal processing of the input signal processed by the space signal-processing method further and to optimize it, time amount signal-processing methods, such as an interference wave canceller, an adaptation filter, and RAKE composition, are proposed.
[0004]
[Problem(s) to be Solved by the Invention] By the way, the optimal method changes by the radio system use situation and the operating environment among various kinds of space signal-processing methods. For this reason, the radio system use situation and the operating environment were specified, the optimal method was chosen based on this specified operating condition and an operating environment, this selected optimal method was fixed, and radio was performed.
[0005] Therefore, if a radio system use situation and an operating environment change, the problem of spoiling communication link effectiveness will arise.
[0006] Even if it chooses the optimal method of each time amount signal-processing method based on a radio system use situation and an operating environment, when similarly an operating condition and an operating environment change, there is a problem of spoiling communication link effectiveness.
[0007] This invention aims at proposing the receiver which can be changed to the optimal receiving method according to a radio system use situation and an operating environment.
[0008]
[Means for Solving the Problem] This invention is set to invention according to claim 1, in order to attain the above-mentioned purpose. A receiving means by which switch to one of receiving methods among each receiving method, and this switched receiving method receives an input signal (30, 40, 50a-50c), According to the input signal for every switched receiving method, one receiving method is determined among each receiving method, and it is characterized by having a setting means (70 80) to set it as this determined receiving method.
[0009] Thereby, according to said switched input signal for every receiving method, one receiving method is determined among each receiving method, and it is set as this determined receiving method. Therefore, it can switch to the optimal receiving method suitable for a radio system use situation and an operating environment.
[0010] Like invention according to claim 2, a setting means may compute the error rate of an

input signal for every switched receiving method, and specifically, it may constitute it so that it may be set as one receiving method based on this computed error rate for every receiving method. Especially, like invention according to claim 3, it has a judgment means to judge whether the error rate of the received input signal is below a predetermined threshold, and a setting means may set up one receiving method, when it judges that an error rate is below a predetermined threshold with a judgment means.
[0011] Moreover, in invention according to claim 4, a setting means may compute SINR of the wave power of choice of an input signal, and interference wave power for every switched receiving method, and may set up one receiving method based on this computed SINR for every receiving method.
[0012] However, SINR is the ratio of the wave power of choice of an input signal, and interference wave power, and is Signal. to Interference plus Noise It is the abbreviation for Ratio.

[0013] And it has a judgment means by which SINR judges whether it is below a predetermined threshold like invention according to claim 5, and a setting means may set up one receiving method, when it judges that SINR is below a predetermined threshold with a judgment means.
[0014] Furthermore, a setting means may be made to set one receiving method as a power up like invention according to claim 6. Moreover, a setting means may be made to set up one receiving method for every fixed period like invention according to claim 7. And it has a positioning means to position positional information, like invention according to claim 8, and when the positioned positional information changes, you may make it a setting means set up one receiving method.
[0015] Incidentally, the sign in the parenthesis of each above-mentioned means is an example which shows correspondence relation with the concrete means of a publication to the operation gestalt mentioned later.
[0016]
[Embodiment of the Invention] One operation gestalt of the receiver of the base station of the W-CDMA system applied to this invention at drawing 1 is shown.
[0017] Drawing 1 is the block diagram showing the outline circuitry of the receiver of a base station. As shown in drawing 1 , a receiver has antenna elements 10a and 10b, the quasi-synchronous detection machines 20a and 20b, the space signal-processing section 30, the time amount signal-processing section 40, Switchers 50a-50c, a demodulator circuit 60, the BER measurement section 70, the change-over control section 80, and memory 90. Antenna elements 10a and 10b receive an electric wave for an input signal as a medium, respectively.
[0018] Here, as a format of an input signal, as shown in drawing 2 , an information symbol and a pilot symbol (known symbol) are arranged by turns, and consist of time sharing. In addition, as an input signal, that to which the spread spectrum of each information symbol and each pilot symbol is carried out is adopted.
[0019] Quasi-synchronous detection machine 20a carries out the quasi-synchronous detection of the input signal received by antenna element 10a, and outputs the quasi-synchronous detection signal R1 (= I1+j-Q1). Moreover, quasi-synchronous detection machine 20b carries out the quasi-synchronous detection of the input signal received by antenna element 10b, and outputs the quasi-synchronous detection signal R2 (=I2+j-Q2).
[0020] The space signal-processing section 30 has the adaptive array-antennas section 31 and the space diversity section 32, and the time amount signal-processing section 40 has the interference canceller 41, the adaptation filter 42, and the RAKE composition section 43. In addition, about the detail configuration of the space signal-processing section 30 and the time amount signal-processing section 40, it mentions later.
[0021] Switcher 50a makes change-over connection of either the adaptive array-antennas section 31 or the space diversity section 32 to the both sides of the quasi-synchronous detection machines 20a and 20b. Switcher 50b makes change-over connection of either the adaptive array-antennas section 31 or the space diversity section 32 any one of the interference canceller 41, the adaptation filter 42, and the RAKE composition sections 43. Switcher 50c makes change-over connection of any one of the interference canceller 41, the

adaptation filter 42, and the RAKE composition sections 43 in a demodulator circuit 60.
[0022] this shows drawing 3 by Switchers 50a-50c -- as -- all the space signal-processing sections 30 and time amount signal-processing sections 40 -- combining -- 1st receiving method - the 6th receiving method can be set up.
[0023] A demodulator circuit 60 carries out recovery processing of the output signal of the time amount signal-processing section 40. Here, as recovery processing, back-diffusion-of-electrons processing, a QPSK recovery, etc. are adopted, for example.
[0024] The BER measurement section 70 has memorized the replica of a pilot symbol beforehand, and the BER measurement section 70 searches for the error rate (BER: block error rate) of the pilot symbol of an input signal based on the replica of a pilot symbol. The change-over control section 80 is equipped with a microcomputer, and this microcomputer performs change-over processing. Memory 90 memorizes various data with the computer program of a microcomputer.
[0025] Next, the detail configuration of the space signal-processing section 30 and the time amount signal-processing section 40 is explained using drawing 4 - drawing 8 . Drawing 4 is drawing showing the configuration of the adaptive array-antennas section 31 of the space signal-processing section 30.
[0026] In drawing 4 , the adaptive array-antennas section 31 has Multipliers 310a and 310b, an adder (sigma) 311, and the weight operation part 312. Multiplier 310a carries out the multiplication of the weight W1 to the quasi-synchronous detection signal R1 of quasi-synchronous detection machine 20a, the multiplication signal R1 and W1 are calculated, and multiplier 310b carries out the multiplication of the weight W2 to the quasi-synchronous detection signal R2 of quasi-synchronous detection machine 20b, and calculates the multiplication signal R2 and W2. An adder (sigma) 311 adds the multiplication signal R1, W1 and the multiplication signal R2, and W2, and searches for an addition signal (R1 and W1+R2, W2) as an output signal RO.
[0027] Here, the weight operation part 312 has memorized the replica P of a pilot symbol beforehand, and this weight operation part 312 updates weight W1 and weight W2 so that the pilot symbol of the addition signal of an adder 311 may be brought close to the replica P of that pilot symbol. Thereby, an interference wave can be oppressed among the output signals RO of an adder 311.
[0028] Drawing 5 is drawing showing the configuration of the space diversity section 32 of the space signal-processing section 30. In drawing 5 , the space diversity section 32 has the channel presumption sections 320a and 320b and the synthetic section 321.
[0029] The channel presumption sections 320a and 320b do the complex division of the replica P to the pilot symbol of the quasi-synchronous detection signal R1 by having memorized the replica P of a pilot symbol beforehand, respectively, and channel presumption section 320a calculates the channel estimate S1. Moreover, channel presumption section 320b does the complex division of the replica P to the pilot symbol of the quasi-synchronous detection signal R1, and calculates the channel estimate S2.
[0030] It adds the multiplication signals G1 and G2, and outputs an addition signal as an output signal RO while the synthetic section 321 carries out complex multiplication of channel presumption S1 to the quasi-synchronous detection signal R1, searches for the multiplication signal G1, carries out complex multiplication of channel presumption S2 to the quasi-synchronous detection signal R2 and searches for the multiplication signal G2.
[0031] However, carrying out complex multiplication of channel presumption S1 to the quasi-synchronous detection signal R1 plays the role which removes the phase fluctuation in a transmission line among the quasi-synchronous detection signals R1. Moreover, carrying out complex multiplication of channel presumption S2 to the quasi-synchronous detection signal R2 plays the role which removes the phase fluctuation in a transmission line among the quasi-synchronous detection signals R2.
[0032] Drawing 6 is drawing showing the configuration of the interference canceller 41 of the time amount signal-processing section 40.
[0033] In drawing 6 , the interference canceller 41 has memory 410, the recovery section 411,

the modulation section 412, and an adder 413. Memory 410 carries out predetermined period maintenance of the output signal RO of the space signal-processing section 30.
[0034] The recovery section 411 carries out recovery processing of the output signal RO, and it asks for an interference wave among output signals RO, and the modulation section 412 modulates the interference wave to which it restored in the recovery section 411, and asks for a modulation interference wave. An adder 413 subtracts the modulation interference wave of the modulation section 412 from the output signal RO memorized by memory 410, and searches for an output signal RG. Thereby, the thing except an interference wave can be outputted as an output signal RG among output signals RO.
[0035] Drawing 7 is drawing showing the configuration of the adaptation filter 42 of the time amount signal-processing section 40. In drawing 7 , the adaptation filter 42 has the delay machines (Z-1) 420-422, multipliers 423-425, an adder (sigma) 426, a signal generator 427, and the weight operation part 428.
[0036] The delay machine 420 outputs the delayed fixed period and delay signal D1 to this output signal RO in response to the output signal RO of the space signal-processing section 30.
[0037] The delay machine 421 receives the delay signal D1 from the delay machine 420, and outputs the delayed fixed period and delay signal D2 to this delay signal D1. The delay machine 422 receives the delay signal D2 from the delay machine 421, and outputs the delayed fixed period and delay signal D3 to this delay signal D2.
[0038] A multiplier 423 receives the delay signal D1 from the delay machine 420, carries out the multiplication of the weight T1 to this delay signal D1, and outputs the multiplication signal K1. A multiplier 424 receives the delay signal D2 from the delay machine 421, carries out the multiplication of the weight T2 to this delay signal D2, and outputs the multiplication signal K2. A multiplier 425 receives the delay signal D3 from the delay machine 422, carries out the multiplication of weight T3 to this delay signal D3, and outputs the multiplication signal K3.
[0039] An adder 426 adds the multiplication signal K1 of a multiplier 423, the multiplication signal K2 of a multiplier 424, and the multiplication signal K3 of a multiplier 424, and outputs the addition signal as an output signal RG.
[0040] A signal generator 427 outputs the replica P of a pilot symbol, and the weight operation part 428 updates weight T1 - T3 so that the pilot symbol of the output signal RG of an adder 426 may be brought close to the replica P. Thereby, an interference wave can be oppressed inside to the output signal RG of an adder 426.
[0041] Drawing 8 is drawing showing the configuration of the RAKE composition section 43 of the time amount signal-processing section 40. In drawing 8 , the RAKE composition section 43 has matched filters 430 and 431, the square machines 432 and 433, an adder 434, an integrator 435, the timing judging machine 436, and the synthetic vessel 437.
[0042]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the electrical circuit configuration of the receiver of the base station concerning 1 operation gestalt of this invention.
[Drawing 2] It is drawing showing a format of an input signal.
[Drawing 3] It is drawing showing a receiving method.
[Drawing 4] It is drawing showing the configuration of the adaptive array-antennas section shown in drawing 1 .
[Drawing 5] It is drawing showing the configuration of the space diversity section shown in drawing 1 .
[Drawing 6] It is drawing showing the configuration of an interference canceller shown in drawing 1 .
[Drawing 7] It is drawing showing the configuration of the adaptation filter shown in drawing 1 .
[Drawing 8] It is drawing showing the configuration of the RAKE composition section shown in drawing 1 .
[Drawing 9] It is the flow chart which shows the actuation of a change-over control section shown in drawing 1 .
[Drawing 10] It is drawing showing the modification of a top Norikazu operation gestalt.
[Description of Notations]
50a-50c -- A change-over machine, 70 -- The BER measurement section, 80 -- Change-over control section.

[Translation done.]